BANGLADESH
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA)
Country Coordinator: Ariful Islam, EcoHealth Alliance
Global Point of Contact: Jon Epstein, EcoHealth Alliance

Partners

- Bangladesh Forest Department (BFD)
- Chittagong Veterinary and Animal Science University (CVASU)
- Department of Livestock Services (DLS)
- Dhaka Medical College Hospital *
- Faridpur Medical College Hospital *
- FAO-ECTAD
- Institute of Epidemiology, Disease Control and Research (IEDCR)
- International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b)

*Partnership in development

Plans subject to change as the budget is finalized; activities presented will be implemented as budget allows.

Prevent and Detect Zoonotic Disease

PREDICT builds the workforce, strengthens systems, and conducts surveillance for priority zoonotic diseases and other emerging threats. In Bangladesh, PREDICT puts One Health in action through zoonotic disease surveillance, sampling of wildlife and people, and conducting behavioral risk investigations at high-risk human-animal transmission interfaces. This work directly supports the national surveillance system, contributes to the development and implementation of the country GHSA roadmap, and provides opportunities to strengthen mechanisms for responding to priority zoonotic diseases, such as highly pathogenic avian influenza, Nipah virus, and other emerging threats. In addition, PREDICT supports the development of Bangladesh's One Health workforce from the national to district levels through field and lab-based training and engagement of national staff, university and NGO partners, and students in surveillance and disease detection activities. In addition to One Health surveillance activities at targeted sites, PREDICT collects non-invasive rhesus macaque samples as part of a longitudinal investigation aimed at understanding how anthropogenic and domestic animal pressure on macaque populations affects likelihood of aggressive contact with people, along with individual animal viral load, viral shedding rates, and subsequent zoonotic disease transmission risks.

Where we work

Madaripur is one of the locations in Bangladesh where macaques are protected. In recent years, the Government of Bangladesh (GoB) ceased feeding the macaques. People and livestock living in this area have regular and frequent contact with macaques here due, in part, to competition for food. The human-macaque contact at this site is often aggressive in nature. PREDICT behavioral risk investigations indicate that contact with macaques occurs frequently, making this an important site to investigate zoonotic disease transmission risks between wildlife, livestock, and people. PREDICT continues to conduct surveillance of urban wildlife and people along with in-depth behavioral risk investigations to characterize disease transmission risk at this important interface.

Dhaka. PREDICT zoonotic disease surveillance sites in the Dhaka districts were selected to understand how anthropogenic and domestic animal pressure on macaque populations affects likelihood of aggressive contact with people, viral load and viral shedding rates of individual animals, and subsequent zoonotic disease transmission risk to people. The urban site in Old Dhaka is a semi-private fenced-in factory lot where macaques are fed by staff, supporting a large troop of macaques in a populous area.

Dinajpur District is located at the border with India, where people move livestock across national boundaries. PREDICT sampling locations in this area were selected based on known livestock movement from India into Bangladesh. We are collaborating with FAO to identify specific market locations for concurrent sampling of wildlife and livestock around markets. Collectively, the team plans to also evaluate the feasibility of tracking livestock at cross-border markets.

Faridpur District in south-central Bangladesh is home to intensifying agriculture, livestock production, and homestead forests that include vast numbers of date palm, the sap of which is harvested and consumed and has been associated with multiple zoonotic disease outbreaks of Nipah virus. PREDICT is targeting bats and other wildlife in Faridpur for surveillance while exploring collaborations with the Government of Bangladesh and US CDC for syndromic surveillance of patients at the Faridpur Medical College Hospital.

Zoonotic Disease Surveillance Sites

- **Madaripur District**: Land Conversion Gradient (urban-rural gradient)
  - Sampling targets:
    - Wildlife: Rhesus macaques, bats, and rodents. Zoonotic disease surveillance at this site is a continuation of a “longitudinal” study; sampling will be conducted along the gradient at six sites within this region (including sites in Dhaka below)

    - Community surveillance targeting people living in close contact with macaques and at local clinics/pharmacies
    - Behavioral risk investigations of people with routine or occupational exposure to wildlife to characterize risk factors for disease transmission

- **Dhaka District**: Land Conversion Gradient & Intensification of Animal Production Systems
    - Sampling targets:
        - Wildlife: Rhesus macaques, bats, and rodents at urban sites along the urban to rural gradient as part of continuing longitudinal zoonotic disease surveillance of macaque and other urban wildlife populations
        - Livestock: Camels at the only known camel farm and seasonal camel market system in Bangladesh with sampling during the religious festival season annually in August and September
        - Behavioral risk investigations of people living in close contact with macaques, along with farm, market workers, and camel handlers
        - Syndromic surveillance at Dhaka Medical College Hospital, the catchment hospital for the region (includes patients from the Madaripur sites)

- **Dinajpur District**: Livestock Trade (Animal Value Chain)
    - Sampling targets:
        - Wildlife: Bats and rodents in and around livestock markets
        - Livestock: Cattle, goats, pigs, and buffalo (sampling by FAO)
        - Community surveillance of people working with/in livestock trading, including the traders, drivers, middle men, and others assisting with handling

- **Faridpur District**: Land-use Gradient (rural to urban; wildlife-human contact)
    - Sampling targets:
        - Wildlife: Bats and rodents in close contact with people involved in date palm sap harvest and consumption
        - If feasible, syndromic surveillance at the Faridpur Medical College Hospital (regional hospital that also serves Madaripur) of meningo-encephalitis patients in collaboration with GoB, ICDRRB, and US CDC; communication and coordination with ICDDRB and CDC to ensure synergy and not duplication of efforts in progress

Strengthening Laboratory Systems

PREDICT directly supports the national laboratory system in Bangladesh by engaging the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) and Institute of Epidemiology, Disease Control and Research (IEDCR,

Ministry of Health and Family Welfare) labs for animal and human sample testing, respectively. Both the ICDDRB and IEDCR labs are critical nodes for outbreak response and surveillance support. In collaboration with FAO, PREDICT's icddr,b lab also works with GoB partners (Central Disease Investigation Laboratory of Department of Livestock Services and Bangladesh Livestock Research Institute Laboratory) to strengthen capacity for disease detection in the national animal health system. Laboratory staff at both icddr,b and IEDCR are highly experienced in techniques required for zoonotic disease detection, and are in communication with our global One Health laboratory network for technical assistance as needed. Together with EPT and government partners, PREDICT fosters communication and coordination between animal and human labs and ministries; provides joint training exercises and routine information exchanges among lab managers, technicians, and ministry focal points; communicates data and findings to inform surveillance; and works to transfer knowledge and disease detection capacity to other labs in the national system.

Animal lab(s): icddr,b (virology laboratory), Central Disease Investigation Laboratory (CDIL) of Department of Livestock Services (DLS), and Bangladesh Livestock Research Institute Laboratory (BLRI)

Human lab(s): IEDCR (virology laboratory)

Workforce Development and Improving Real-time Surveillance

PREDICT provides critical hands-on and on-the-job training to strengthen One Health workforce capacity in Bangladesh for government staff from national to subnational levels, university staff and students, research institutes, and local communities. By providing opportunities to put One Health in action across the full spectrum of skills required for safe and effective zoonotic disease surveillance, PREDICT strengthens Bangladesh's capacity to sample animals and people, investigate behaviors associated with zoonotic disease transmission, detect priority zoonotic diseases and emerging threats, and perform data analyses to understand zoonotic disease risks. Staff from the Bangladesh Forest Department are involved in field surveillance activities and will continue to be engaged to ensure the successful operationalization of the One Health approach. PREDICT works across ministries and sectors, helping to build and operationalize the national One Health platform through the One Health Secretariat, improve communications and linkages across animal and human sectors by sharing data and findings on zoonotic diseases and the enabling behaviors underlying transmission, and support the Government of Bangladesh (when approved by PREDICT management team) for outbreak preparedness and response.

This year, as part of global efforts to validate One Health approaches through the development of an evidence base and case studies that inform policies for risk

reduction, a One Health Economics Fellow based at IEDCR will examine economic impacts of past and prospective emerging infectious disease events in Bangladesh by assessing effects on different sectors and examining resource flows. This project seeks to determine how to optimally allocate resources to address pandemic threats, whether devising strategies to mitigate the underlying causes or providing the necessary knowledge for individuals, businesses, and society as a whole, to minimize economic damages in the event of a pandemic.

INDONESIA
Year 4 (October 2017-September 2018)

Implementing Partners: EcoHealth Alliance (EHA) with the Primate Research Center of the Institut Pertanian Bogor (PRC-IPB) and Eijkman Institute for Molecular Biology (EIMB)
Country Coordinator: Dr. Joko Pamungkas, PRC-IPB
Global Point of Contact: Dr. Kevin Olival, EHA

Partners

- Animal Disease Investigation Center at Maros, South Sulawesi Province, at Denpasar, Bali Province, and at Banjarbaru, South Kalimantan Province
- FAO ECTAD Indonesia
- Gorontalo State University, Gorontalo
- Kawangkoan Primary Health Clinic (Puskesmas Kawangkoan), Minahasa District, North Sulawesi
- Local offices of Livestock and Animal Health Services at Southeast Sulawesi Province (both provincial and district levels)
- Local offices of Livestock and Animal Health Services at West Sulawesi Province (both provincial and district levels)
- Minahasa District Health Office (Dinas Kesehatan Kabupaten Minahasa)
- Ministry of Agriculture
- Ministry of Environment and Forestry
- Ministry of Health, National Institute of Health Research and Development
- Noongan Hospital (Rumah Sakit Umum Daerah Noongan), Minahasa District, North Sulawesi
- Provincial Health Office in North Sulawesi and Gorontalo Provinces (Dinas Kesehatan Provinsi Sulawesi Utara dan Gorontalo)
- Sam Ratulangi University, Manado, North Sulawesi
- USAID EPT-2 One Health Workforce
- USAID EPT-2 Preparedness and Response
- USAID-Indonesia

Plans subject to change as the budget is finalized; activities presented will be implemented as budget allows.

Prevent and Detect Zoonotic Disease

PREDICT builds the workforce, strengthens systems, and conducts surveillance for priority zoonotic diseases and other emerging threats. In Indonesia, PREDICT puts One Health in action through zoonotic disease surveillance by sampling wildlife and people and conducting behavioral risk investigations at high-risk human-animal transmission interfaces. This work directly supports the national surveillance system and provides opportunities to strengthen mechanisms for responding to priority zoonotic diseases. In addition, PREDICT supports the development of Indonesia's One Health workforce from the national to district

levels through field and lab-based training and engagement of national staff, university and NGO partners, and students in surveillance and disease detection activities.

Where we work

Indonesia is a vast and ecologically diverse country and a global biodiversity hotspot. PREDICT activities are centered at several sites on **the Island of Sulawesi**, the fourth largest island in Indonesia. While considered only one of many high-risk areas in Indonesia, Sulawesi is an important site for the wildlife trade and is undergoing rapid land conversion and exploitation of its local fauna. PREDICT surveillance sites in North Sulawesi and Gorontalo provinces were targeted to capture high-risk animal-human interfaces along the wildlife value chain pathway of zoonotic disease emergence, as bats, rodents, non-human primates, and other species are extensively traded for food across this region. These sites capture different stages of the wildlife value chain, from wild source populations of animals, to hunters and middle men, to urban wildlife markets. At these sites, PREDICT conducts concurrent zoonotic disease surveillance of wildlife, domestic animals (in collaboration with FAO-ECTAD partners) and people along with behavioral risk investigations in communities, such as the North Sulawesi markets where live and butchered wildlife are sold for human consumption and from rural and other sites where wildlife hunting and trading from source populations is occurring. Concurrent sampling of domestic animals by FAO-ECTAD overlaps with PREDICT surveillance in Gorontalo, North Sulawesi, and West Sulawesi, though not in the same geographic areas. Finally, PREDICT plans to conduct syndromic surveillance of patients with acute febrile and respiratory illness in local hospitals and clinics within a catchment area that overlaps with animal surveillance activities.

Zoonotic Disease Surveillance Sites

- **North Sulawesi and Gorontalo provinces:** wildlife trade
  - Sampling targets:
    - Wildlife: wild animals captured for trade and human consumption, primarily bats and rodents with opportunistic sampling of macaques in markets when available
    - FAO-led sampling of domestic animals with PREDICT-assisted testing at regional Disease Investigation Center (Maros, Denpasar, and Banjarbaru)
    - Syndromic surveillance of patients with acute febrile and respiratory illness at Noongan Hospital (Rumah Sakit Umum Daerah Noongan) and the Kawangkoan Primary Health Care Center (Puskesmas Kawangkoan)
    - Behavioral risk investigations with healthy individuals that have

occupational exposure from working with wildlife and livestock
    - Community surveillance of people at high-risk interfaces

- **West Sulawesi, Majene**: wildlife trade
    - Sampling targets:
        - Wildlife: wild animals, primarily bats captured for trade and human consumption and rodents in and around dwellings, fields, or other areas with likely contact with people
        - Behavioral risk investigations with individuals involved in wildlife trade
        - FAO-led sampling of domestic animals with PREDICT-assisted testing at regional Disease Investigation Center (Maros, Denpasar, and Banjarbaru)
        - Community surveillance of people at high-risk interfaces*

- **Southeast Sulawesi, South Konawe**: wildlife trade
    - Sampling targets:
        - Wildlife: wild animals, primarily bats captured for trade and human consumption and rodents in and around dwellings, fields, or other areas with likely contact with people
        - Behavioral risk investigations with individuals involved in wildlife trade
        - Community surveillance of people at high-risk interfaces*

*contingent upon approval of IRB amendment

Strengthening Laboratory Systems

PREDICT supports the development of the national laboratory system and One Health laboratory network in Indonesia by engaging the Primate Research Center at Institut Pertanian Bogor as the primary laboratory for wildlife sample testing and the Eijkman Institute for Molecular Biology for human testing. Both labs provide critical support to the national surveillance and outbreak response system, and laboratory staff are highly experienced in techniques required for zoonotic disease detection, including detection of emerging viral threats, and maintain capability to conduct additional tests for other viral panels and serological assays upon request and as budget allows. Through this network, and in collaboration with FAO, PREDICT provides training in biosafety and zoonotic disease detection to local laboratory staff and strengthens the laboratory capacity of the Ministry of Agriculture's Animal Disease Investigation Center (DIC), especially at Maros, Denpasar, and Banjarbaru, where PREDICT techniques are actively engaged in livestock and domestic animal surveillance. PREDICT, in collaboration with EPT and government partners, also fosters communication and coordination between animal and human labs and ministries; provides joint training exercises and routine information

exchanges among lab managers, technicians, and ministry focal points from national to subnational levels; communicates data and findings to inform surveillance; and works to transfer knowledge and disease detection capacity to other labs in the national system (e.g., the DICs).

Animal lab(s): Primate Research Center at Institut Pertanian Bogor, Bogor with support (in collaboration with FAO) to the Ministry of Agriculture's Animal Disease Investigation Centers (DICs)

Human lab (s): Eijkman Institute for Molecular Biology (EIMB), Jakarta

Workforce Development and Improving Real-time Surveillance

PREDICT provides critical hands-on and on-the-job training to strengthen One Health workforce capacity in Indonesia for government staff from national to subnational levels, including individuals from the Ministry of Environment and Forestry, Ministry of Health, and Ministry of Agriculture, university staff and students, research institutes, and local communities. By providing opportunities to put One Health in action across the full spectrum of skills required for safe and effective zoonotic disease surveillance, PREDICT strengthens Indonesia's capacity to sample animals and people, investigate behaviors associated with zoonotic disease transmission, detect priority zoonotic diseases and emerging threats, and perform data analyses to understand zoonotic disease risks. This year, PREDICT plans to conduct a workshop on safe wildlife sampling for veterinarians and/or veterinary paramedics who work in the Ministry of Environment and Forestry. The workshop will be organized in coordination with USAID-Indonesia's PRESTASI program and will include a hands-on training for the collection of specimens from bats and rodents in the field. Additional on-site trainings on biosafety and biosecurity, zoonotic disease detection, and bioinformatics analysis are planned with government and medical faculty and staff from laboratories in the region, and a collaborative workshop in disease risk mapping is being planned with FAO partners to support Kemenko PMK's developing risk analytic and mapping capabilities.

PREDICT works across ministries and sectors, helping to build and operationalize the national One Health platform, and improves communications and linkages across animal and human sectors through data sharing and communications on zoonotic diseases and the enabling behaviors underlying transmission. When approval by the Government of Indonesia authorities is obtained, PREDICT findings are disseminated to all other relevant partners. PREDICT also works closely with EPT's P&R and the Coordination Ministry for Human Development and Cultural Affairs (Kemenko PMK) to support activities with local government agencies in North Sulawesi. In addition, PREDICT supports the Government of Indonesia as requested (when approved by PREDICT management team) in outbreak preparedness and response.